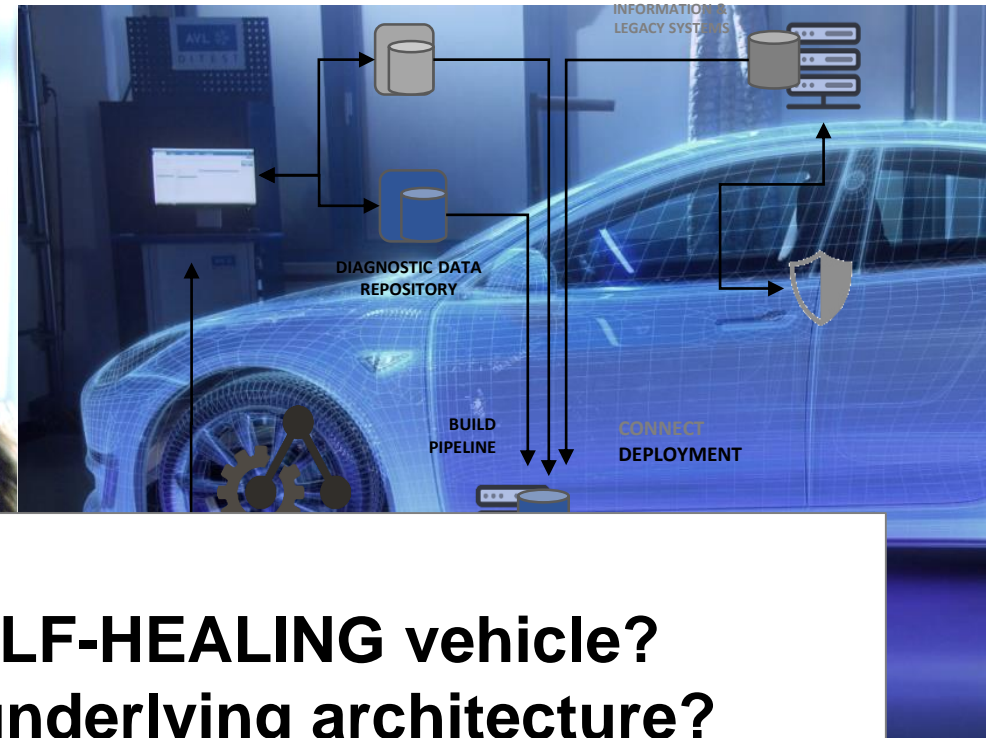
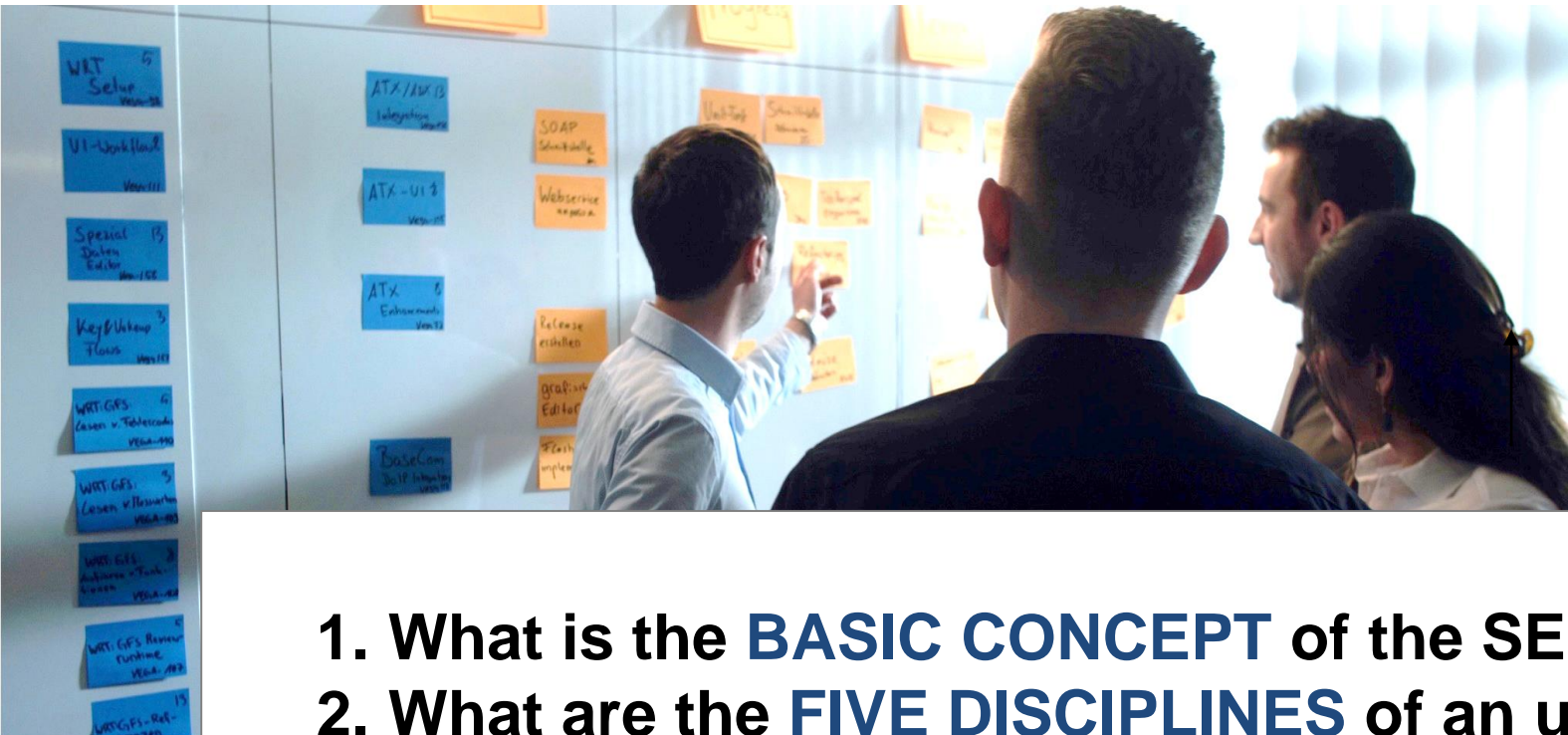




CHALLENGES AND ENABLERS FOR THE **SELF-HEALING VEHICLE**

Marcel Wendland, MSC, MBA
Head of R&D

WHAT YOU WILL LEARN?



1. What is the **BASIC CONCEPT** of the **SELF-HEALING** vehicle?
2. What are the **FIVE DISCIPLINES** of an underlying architecture?
3. What are the top **ENABLERS** and **ROADBLOCKS** on this roadmap?

WHO IS AVL DITEST?



... AND WHY WE SPEAK DATA?



36.589 vehicle diagnostic sessions per day

199.068 user interactions per day

862.628 diagnostic trouble codes per week

17,8 terabyte per month

ONE source for data analytics

WHO ARE YOU?

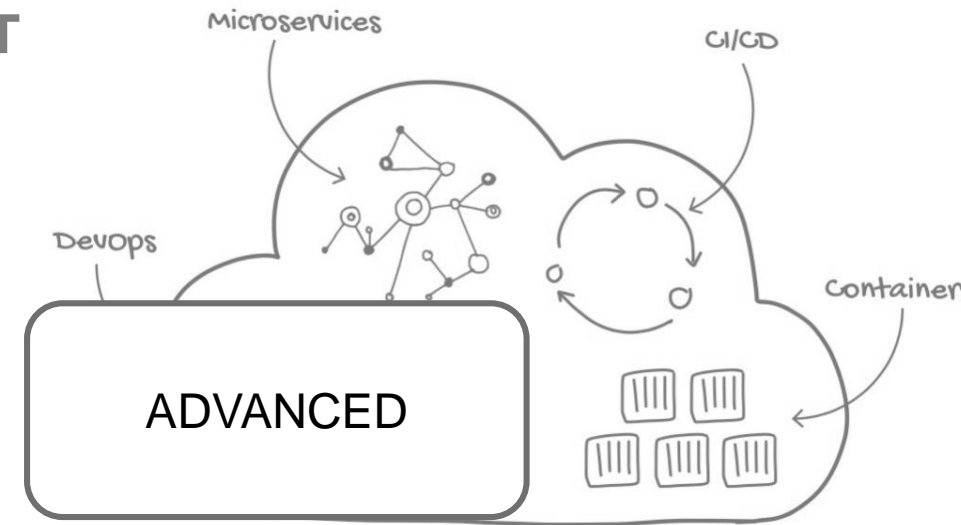
HOW MUCH YOU KNOW ABOUT
DATA ANALYTICS?



BEGINNER

INTERMEDIATE

ADVANCED



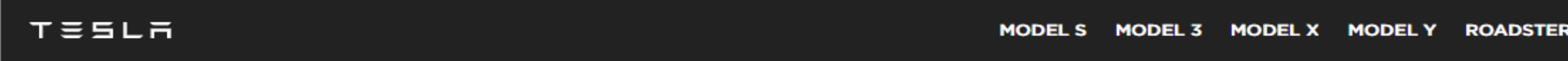
WHY A SELF-HEALING CAR?



D I T E S T



WHAT WERE THE ENABLERS?



Introducing Software Version 10.0

1hr Tesla Team • 26. September 2019



It's here. Software Version 10.0 – our biggest software update ever. We're raising the bar for what people have come to expect from their cars with new entertainment, gaming, music, and convenience features designed to make your car much more capable, as well as making time spent in your car more fun.

This week, Tesla owners around the world will start waking up to Version 10.0 features via an over-the-air update. Here's a look at what's new:

Source: TESLA

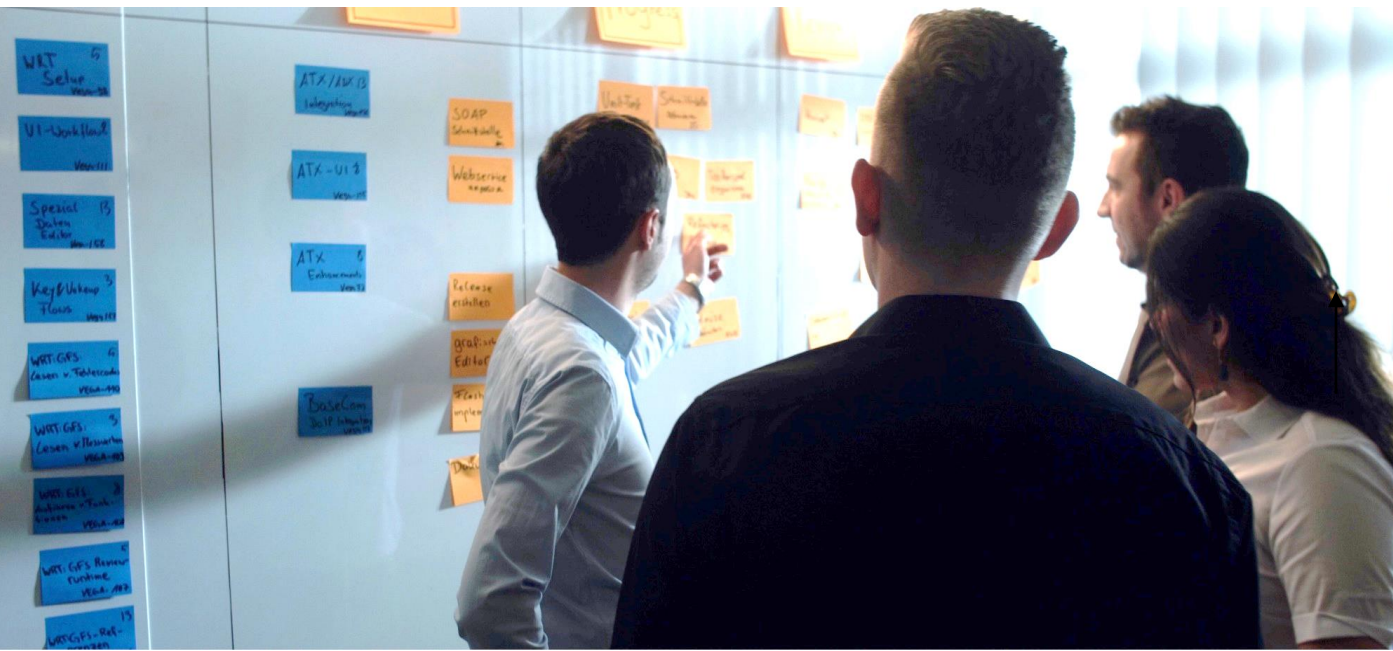
WHAT WERE THE ENABLERS?

VOLKSWAGEN AUTOMOTIVE CLOUD



Source: Microsoft

WHAT ARE THE PRINCIPLES OF A SELF-HEALING VEHICLE?



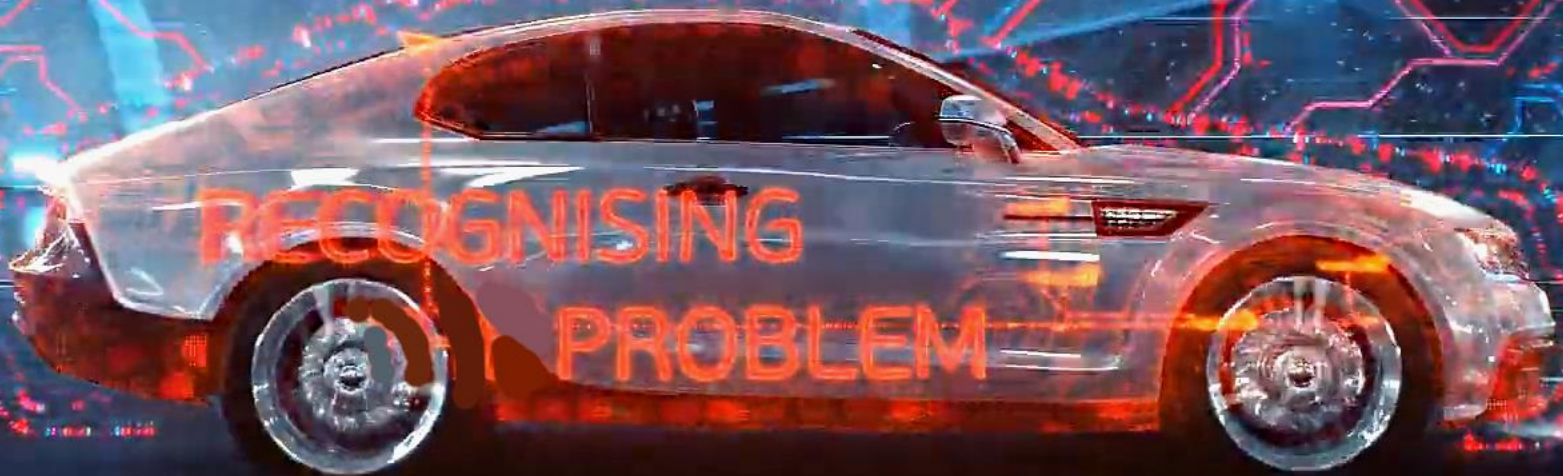
00:14:09

SYSTEM

RX12755

12_AVI_MONITOR

RECOGNISING PROBLEM



CONTROL SYSTEM

Searching ID 12v25

INDEX OF SECURITY

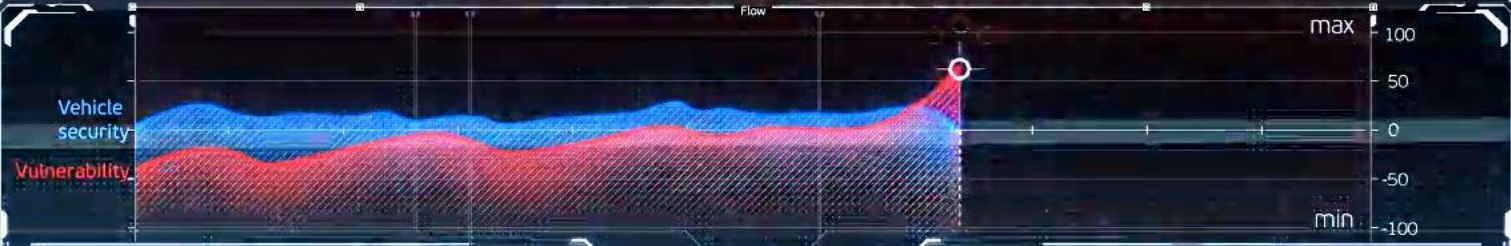
593 points

BATTERY CHARGING

06 dB

MOTION CONTROL

6%



29

FREQUENCY MHz

337

SIGNAL LEVEL

13

TEST LEVEL %

15

TEST LEVEL %

CONNECT

00:05:42

NEXT UI GEN SET10

RX347[5]

FRAME UI GATE 50 G2

12. AVL MONITOR

SYST TEMP
MAX 28.8 35.8
MIN 93.9 91.0

TRANSMISSION TOWER

RECEIVING
SENDING



TRANSFERRING & STORING

CONTROL SYSTEM

Searching ID 12x25

INDEX OF SECURITY

577

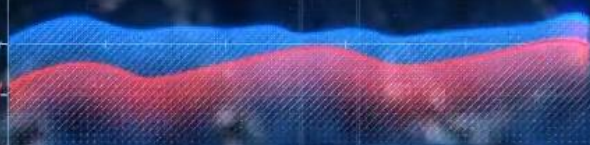
BATTERY CHARGING

58

MOTION CONTROL

6

Vehicle security
Vulnerability



CONNECT

max 100
50
0
-50
-100
min

12 TEST LEVEL %
7 TEST LEVEL %

25 FREQUENCY MH
329 SIGNAL LEVEL

15 TEST LEVEL %
14 TEST LEVEL %

00:05:42

NEXT UI GEN SET:10 RX347[5] FRAME UI GATE 50 G2 12. AVL MONITOR

Flash ECU Summary

| | | | |
|---|---|---|---|
| Amount of Sessions 6 Keine Daten | Amount of Tool Starts 12 Keine Daten | Amount of Errors 2 Keine Daten | Amount of Success 10 Keine Daten |
|---|---|---|---|

All starts by type

The amount of each type

All starts by status

The amount of each status

All starts by title

The amount of each title

All starts by resource

The amount of each resource

| Type (2) | Starts | Status (2) | Starts | Title (4) | Starts | Resource | Starts |
|--|--------|---|--------|---|--------|---|--------|
| <input checked="" type="checkbox"/> DF_FLASH | 6 | <input checked="" type="checkbox"/> OK | 11 | <input checked="" type="checkbox"/> Connect... | 4 | <input checked="" type="checkbox"/> adapter | 4 |
| <input checked="" type="checkbox"/> DF_TOOLBOX | 2 | <input checked="" type="checkbox"/> ERROR | 1 | <input checked="" type="checkbox"/> HELMAG... | 1 | <input checked="" type="checkbox"/> yellow | 1 |
| <input checked="" type="checkbox"/> FLASH_ECU | 1 | | | <input checked="" type="checkbox"/> Preflash... | 3 | <input checked="" type="checkbox"/> serial-hy | 3 |

Flash status

What status did we have when the flash tool was finished?

Flash starts, aborts, errors

How many tool starts, aborts and errors did we have?



ANALYZING THE PROBLEM

FINANCIAL SALES

SALES BY DIVISION (20%)

Share of market activity

Distribution of the securities market

| ASK | BID | QTY | DATE | BID | ASK | PRICE | LIQUID |
|----------|---------|-----|------|-----|---------|----------|--------|
| € 100.00 | € 99.00 | 320 | 754 | 272 | € 99.00 | € 100.00 | 600 |
| € 100.00 | € 99.00 | 450 | 144 | 254 | € 99.00 | € 100.00 | 904 |
| € 100.00 | € 99.00 | 550 | 874 | 634 | € 99.00 | € 100.00 | 954 |
| € 100.00 | € 99.00 | 145 | 124 | 224 | € 99.00 | € 100.00 | 984 |
| € 100.00 | € 99.00 | 784 | 954 | 247 | € 99.00 | € 100.00 | 974 |
| € 100.00 | € 99.00 | 801 | 107 | 107 | € 99.00 | € 100.00 | 974 |
| € 100.00 | € 99.00 | 107 | 107 | 107 | € 99.00 | € 100.00 | 941 |
| € 100.00 | € 99.00 | 936 | 107 | 107 | € 99.00 | € 100.00 | 802 |
| € 100.00 | € 99.00 | 214 | 107 | 107 | € 99.00 | € 100.00 | 715 |
| € 100.00 | € 99.00 | 104 | 107 | 107 | € 99.00 | € 100.00 | 557 |

CONTROL SYSTEM

Searching ID 12x25

INDEX OF SECURITY
577 points

BATTERY CHARGING
58 kWh

MOTION CONTROL
6 %



12 TEST LEVEL %

25 FREQUENCY MH

15 TEST LEVEL %

7 TEST LEVEL %

329 SIGNAL LEVEL

14 TEST LEVEL %

CONNECT

00:05:42

NEXT UI GEN SET 10

RX347[5]

FRAME UI GATE 50 Q2

12. AVL MONITOR

SYST TEMP
MAX 29.9 35.8
MIN 99.9 49.0

TRANSMISSION TOWER

RECEIVING
SENDING



CONTROL SYSTEM

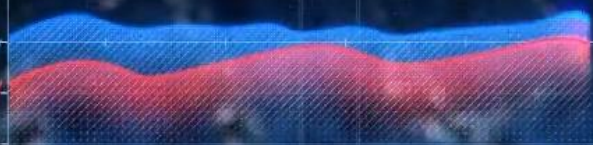
Searching ID 12x25

INDEX OF SECURITY 577 points

BATTERY CHARGING 58 kWh

MOTION CONTROL 6 %

Vehicle security
Vulnerability



max 100
50
0
-50
-100
min

12 TEST LEVEL %
25 FREQUENCY MH
329 SIGNAL LEVEL
15 TEST LEVEL %
14 TEST LEVEL %

CONNECT

00:18:06

SYST TEMP

RX347[5]

12. AVL MONITOR

MAX

MIN

UPDATING



-25 20 10 7 5 3 1 0 +1 +3 +5 +7 +10 +20

Flow

max

100

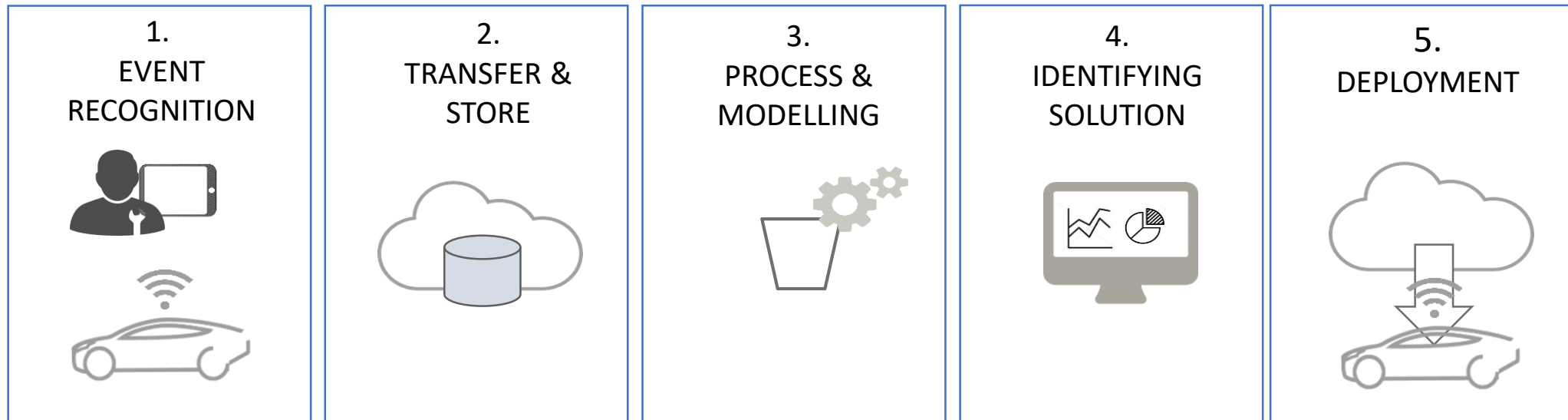
CONTROL SYSTEM

OUT

IN

Vertical text on the left side of the dashboard.

FIVE DISCIPLINES OF CLOUD-BASED SOFTWARE UPDATES



WHAT DO **YOU** THINK WHERE ARE THE **CHALLENGES** FOR A SELF-HEALING VEHICLE?

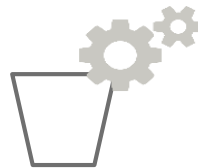
1.
EVENT
RECOGNITION



2.
TRANSFER &
STORE



3.
PROCESS &
MODELLING



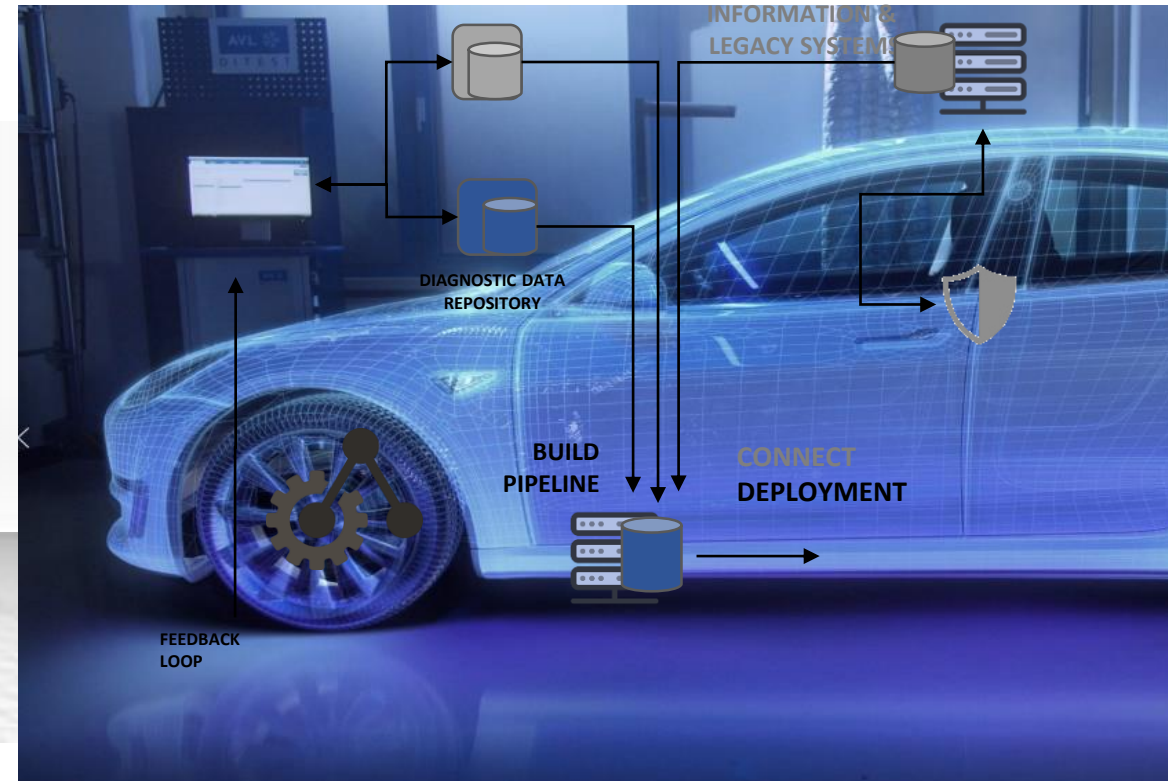
4.
IDENTIFYING
SOLUTION



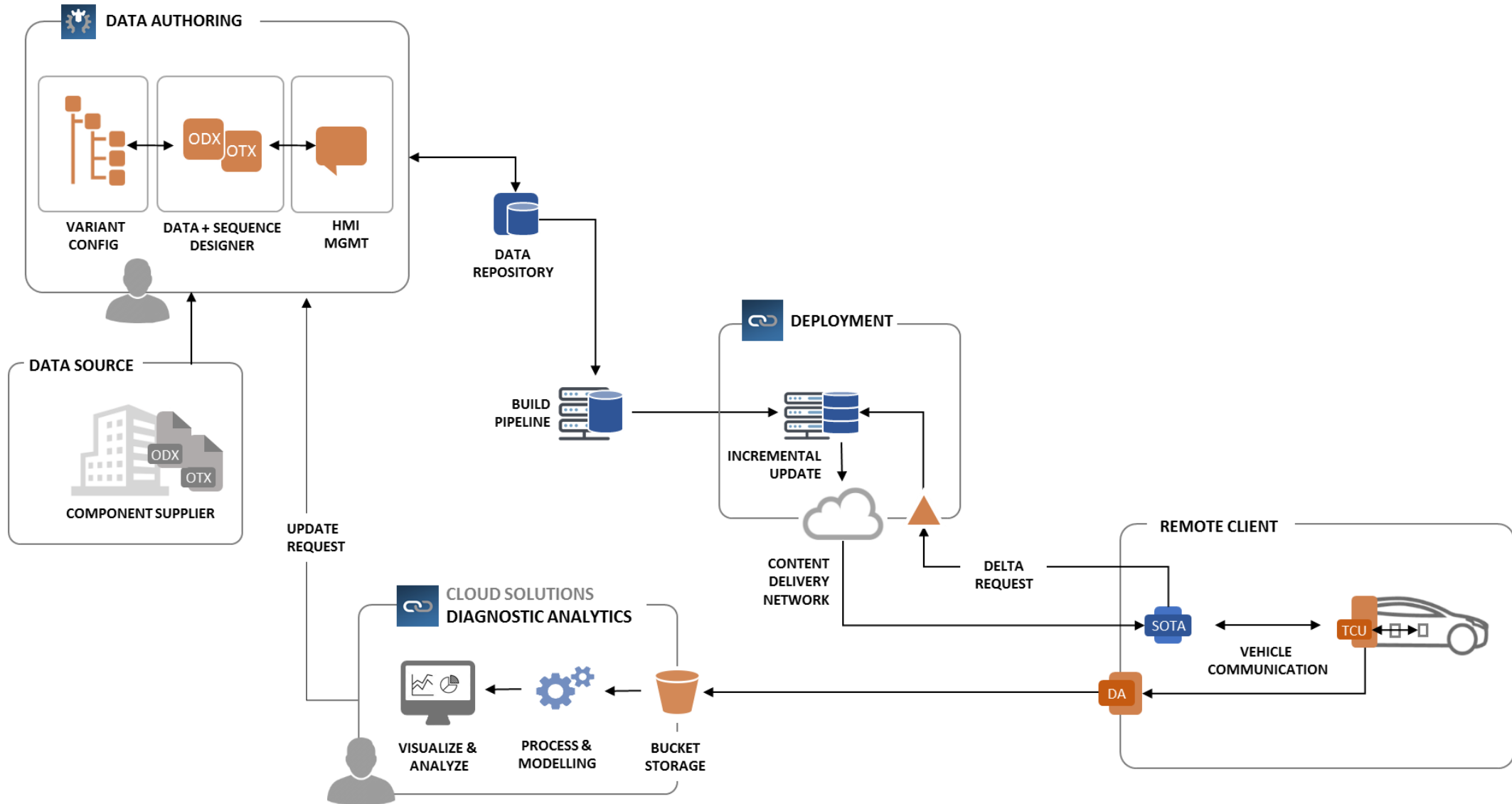
5.
DEPLOYMENT



THE VEHICLE ARCHITECTURAL CHALLENGE

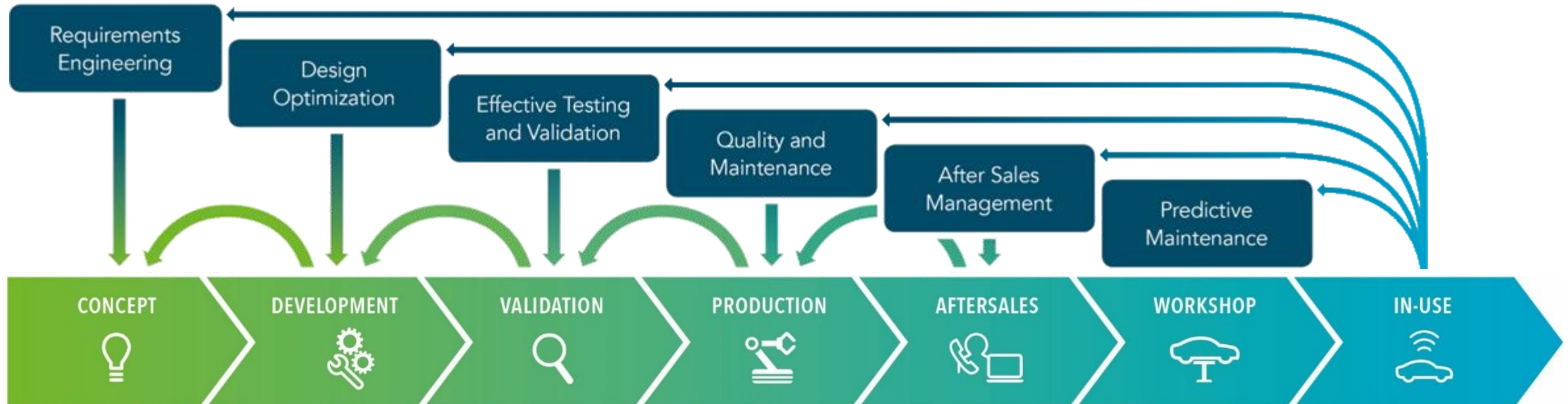


THE „IT“ CHALLENGE

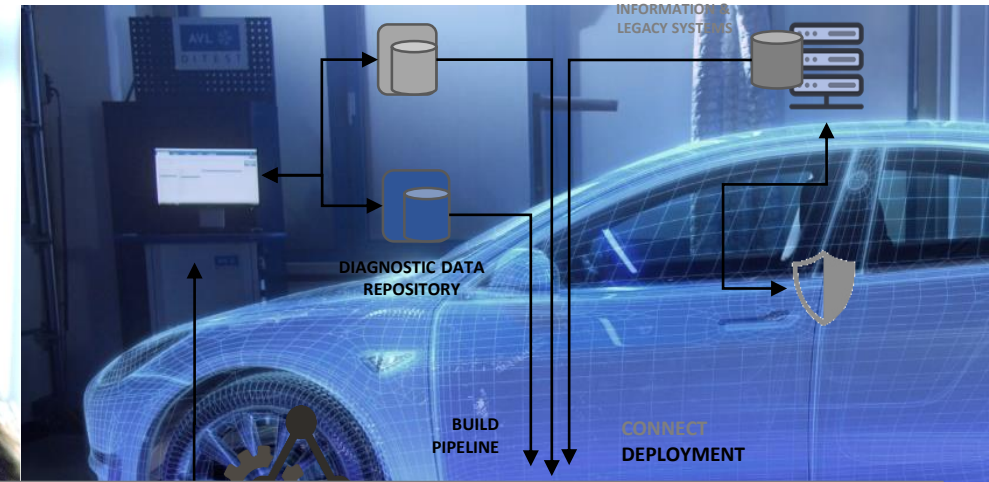
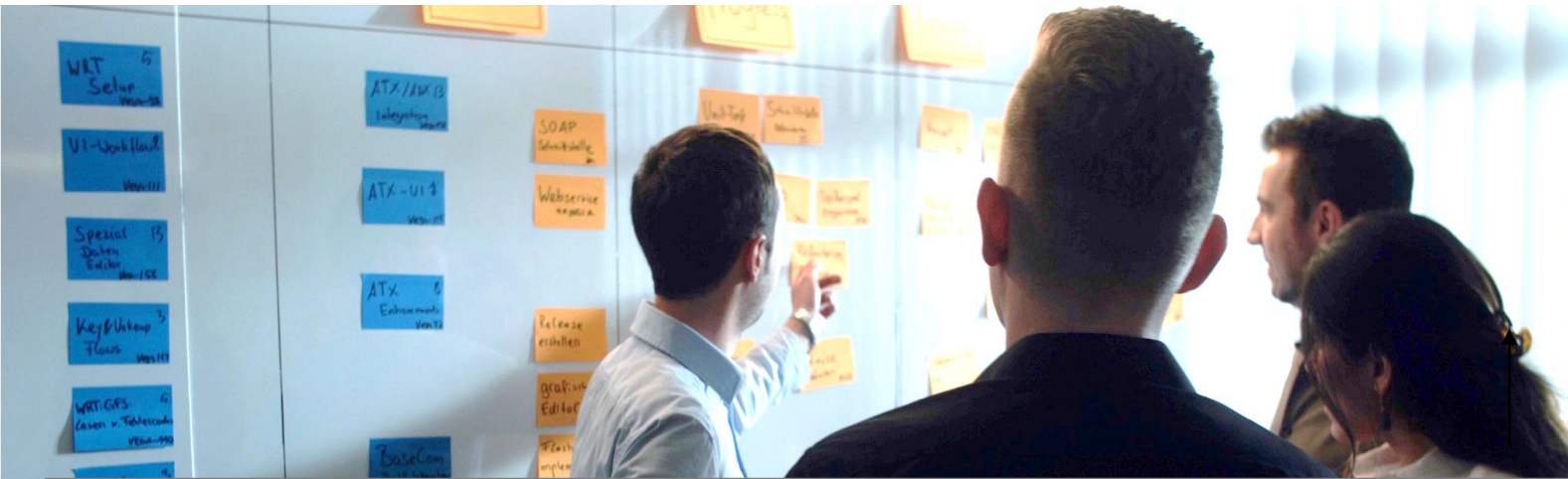


THE ORGANISATIONAL CHALLENGE

DATA-DRIVEN DEVELOPMENT



IN A NUTSHELL



**The vision of the self-healing vehicle ...
... is great and promising.
... will change the service & aftersales organizations tremendously.
... has more organizational than technical challenges.**

THANK YOU!



CONTACT:
MARCEL.WENDLAND@AVL.COM

CONTACT ME ON LINKEDIN 